

**Workshop on Remote
Access to the TEAM
June/23/'08**



Practical Aspects and Requirements of Remote Microscopy Operation for Research-oriented Applications

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Conventional User Operations

NCEM

At User Facilities

1. User's visit to facilities

- The best (normal) way to conduct research
- **Travel expense (both time and money)**

2. Sending specimens with detail descriptions

- No travel expense (only shipping cost)
- **The descriptions are never detail enough**
- **Communication problems**



Conventional User Operations

NCEM

At User Facilities

1. User's visit to facilities

- The best (normal) way to conduct research
- Travel expense (both time and money)

1.5. Sending specimens with a messenger (student)

- Travel expense
- Compensate communication problems

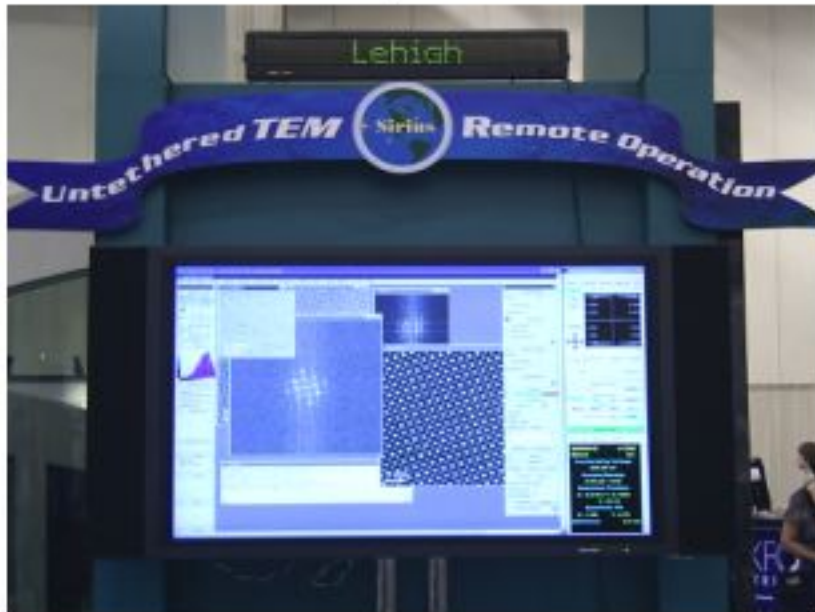
2. Sending specimens with detail descriptions

- No travel expense (only shipping cost)
- The descriptions are never detail enough
- Communication problems

Can Remote Operations be the Solution?

Remote microscopy operations are good at exhibitions and class work

Live demo at Chicago convention center



Microscopy & Microanalysis 2006

Remote SEM Control Activities

Remote Control Microscopy Used at the Lehigh University Microscopy School.

Remote Control of the EMAL XL30FEG during the Laboratory Classes at the Lehigh Microscopy School.

In June 2003 after doing three years of Internet2 remote control demonstrations of the EMAL XL30FEG to attendees of the Lehigh Microscopy School, we branched out into actually using the remotely controlled microscope in the laboratory classes.



Remote Control now done on a laptop using VNC-Overlay, a modified version of VNC programmed by Artem Dmytrenko an EECS student who worked for me. Good programmer!

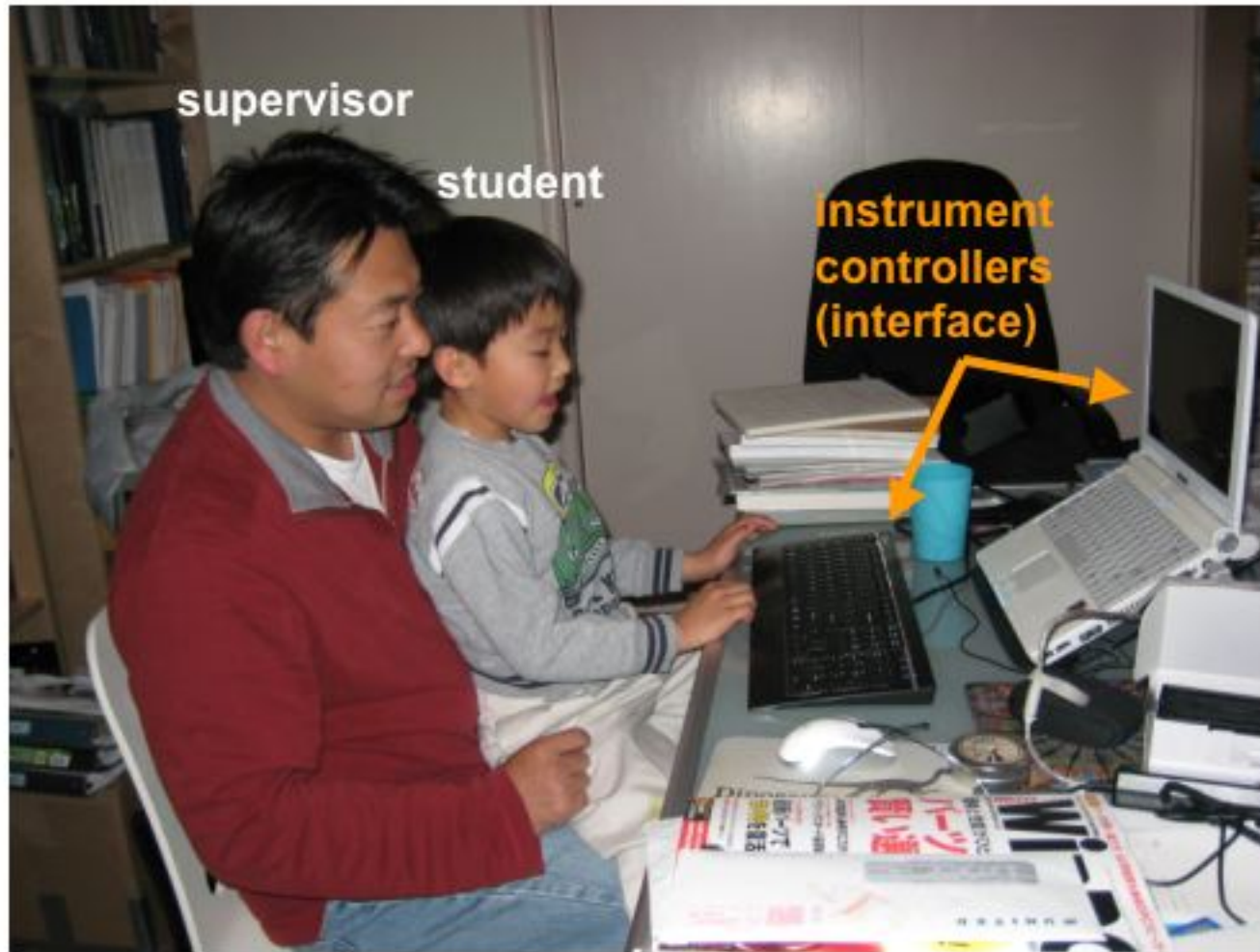
From John Mansfield's homepage

<http://www.emal.engin.umich.edu/People/jfmjfm/jfmjfm.html>

Question: can we really use the remote microscopy operations for research applications at user facilities?



0th-order Remote Operation



We have already experienced the remote operation in some degree!

0th-order Remote Operation with Distance



As long as live interaction is established, 0th-order remote control should be OK. Good for class work as well.

Remote Operation?



Case 1: Imago LEAP APT Instrument

Analytical capabilities

Analysis volume:
up to 1000 nm in depth
(over 100 M atoms)
in few hours

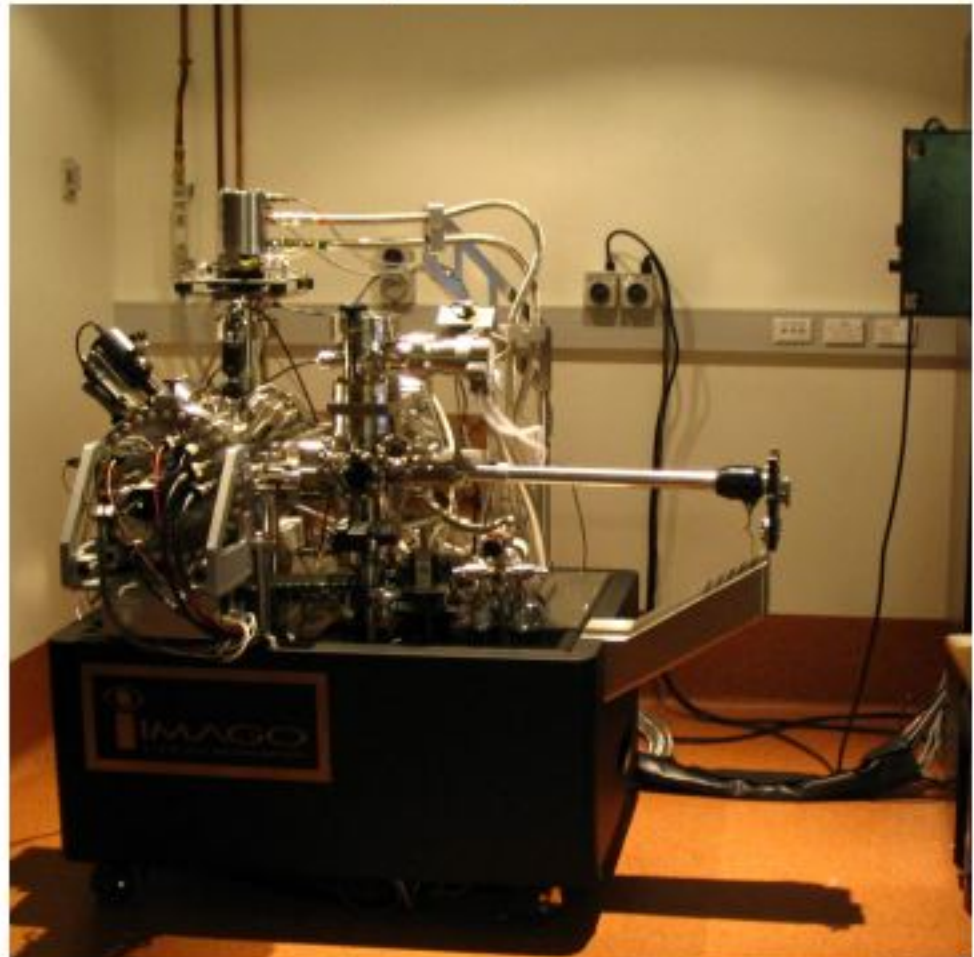
Field of view: 100 nm

Spatial resolution:
0.4 nm (laterally)
0.2 nm (depth)

Sensitivity: ~20 ppm



IMAGO
SCIENTIFIC INSTRUMENTS



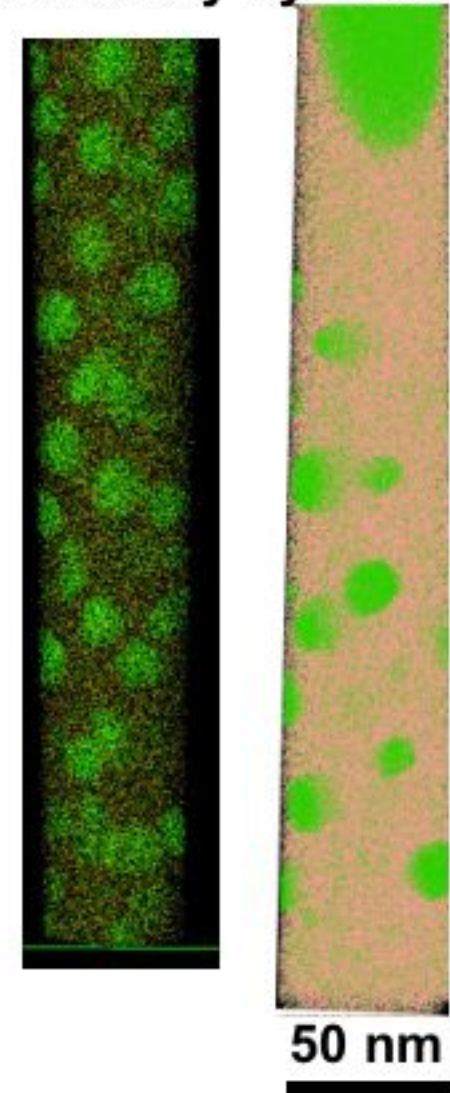
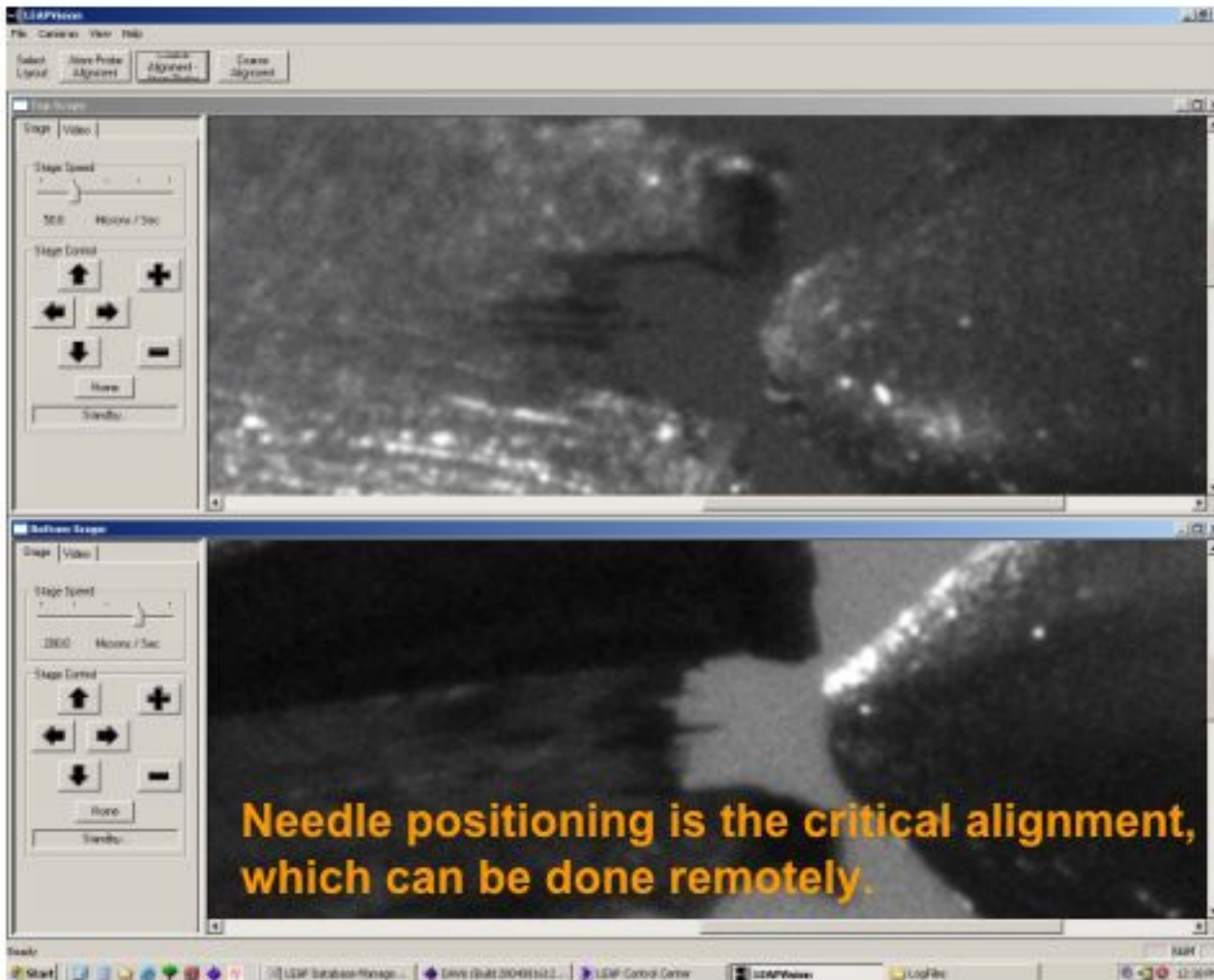
Instrument is designed for complete computer control

Remote Control of LEAP at Sydney, AU

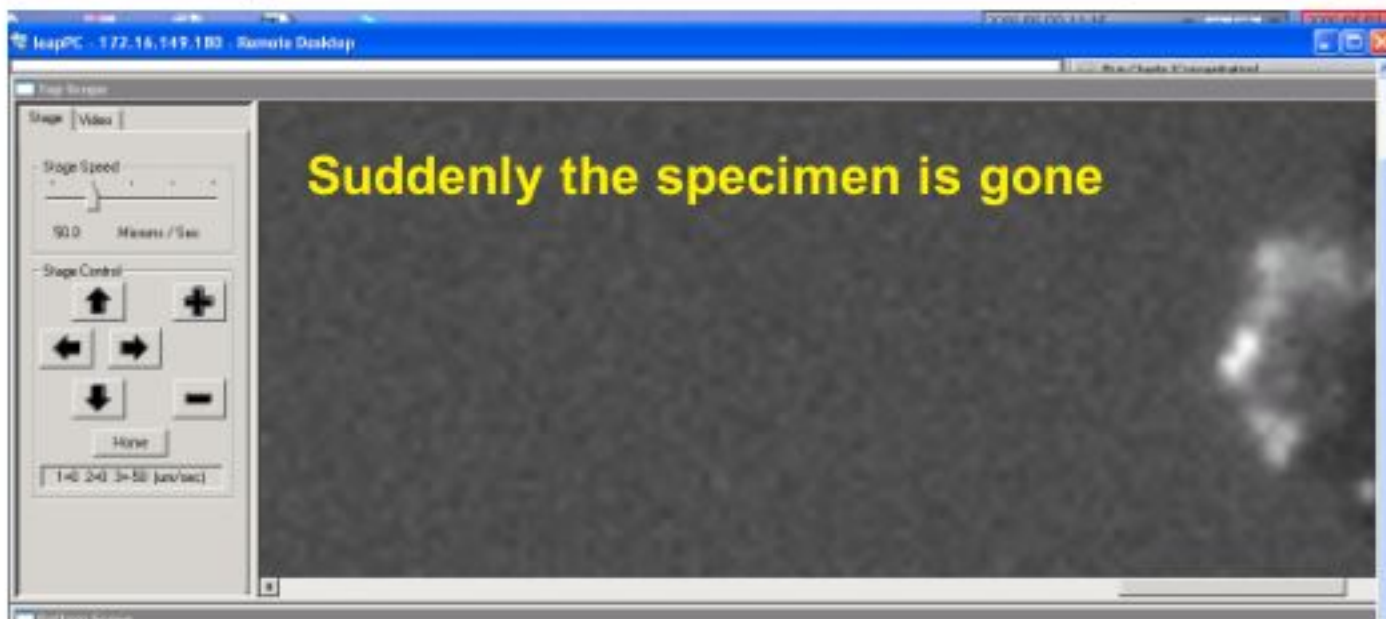
NCEM

Remote control was performed via Windows Remote desktop with Cisco VPN software to connect network at U. of Sydney

APT maps obtained from Ni-base alloy by LEAP

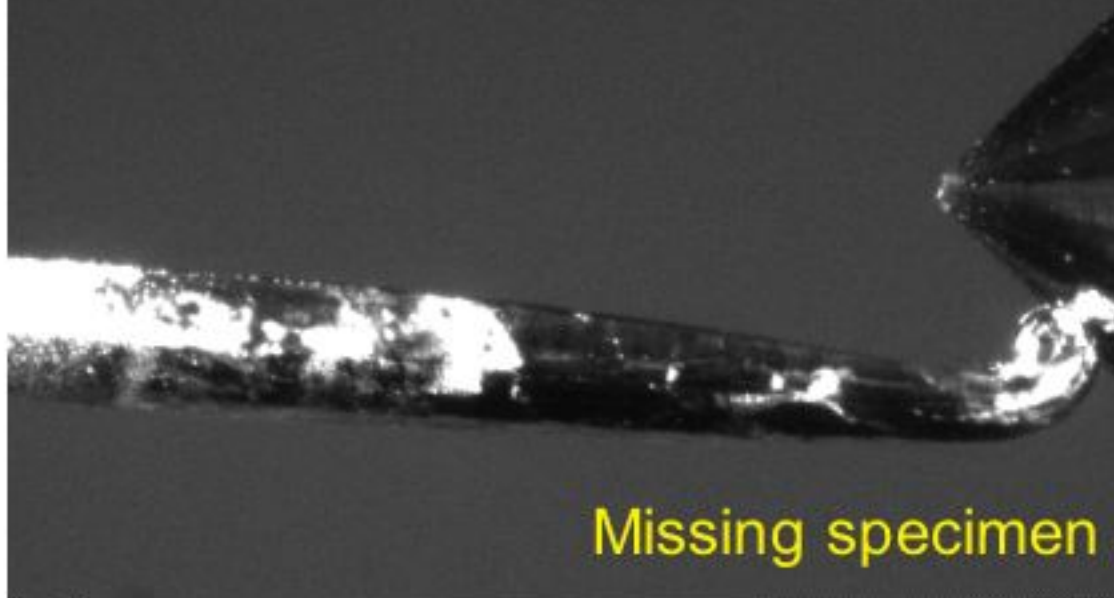


Remote Alignment of Needle position



Lesson & Learn from the Missing Specimen

Next day, I received an e-mail from Sydney with an attached image.

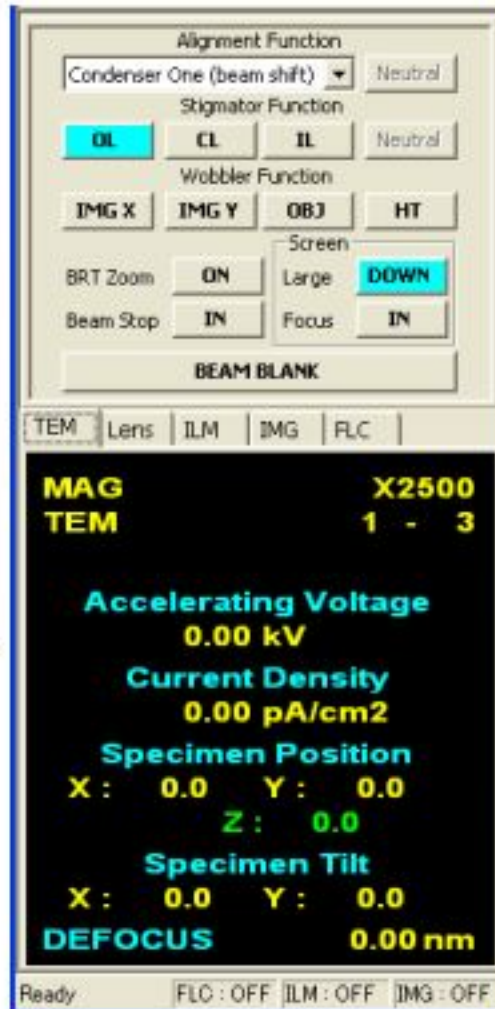
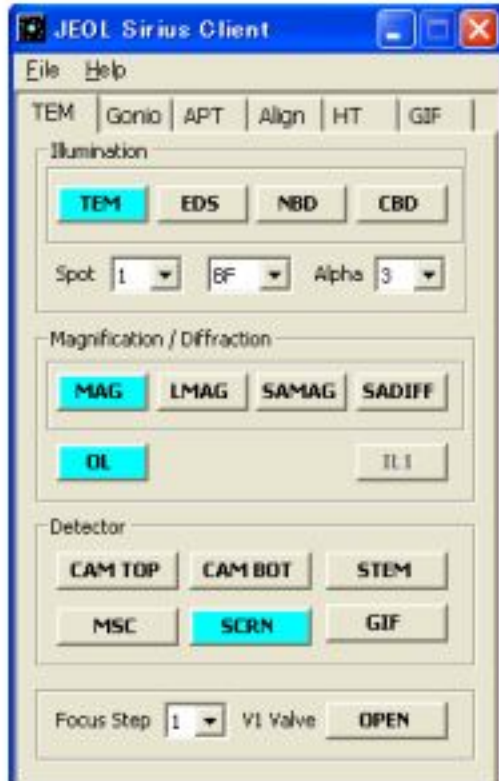


- ❑ Remote operations require faster network speed since these operations are video intensive.
(slow-speed WiFi (from couch) should not be used)
- ❑ Intensive support from the local site is essential
(to cover remote users' mess)

Case 2: Sirius System for JEOL TEMs

NCEM

Sirius software



Sirius hardware: knob sets

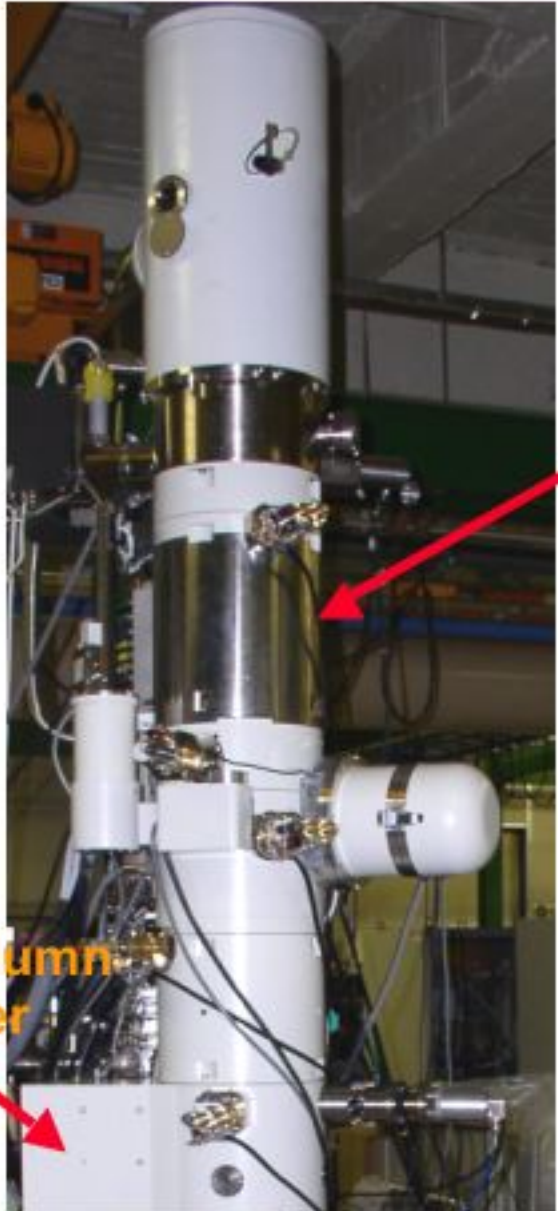


Remote from NCEM to Lehigh

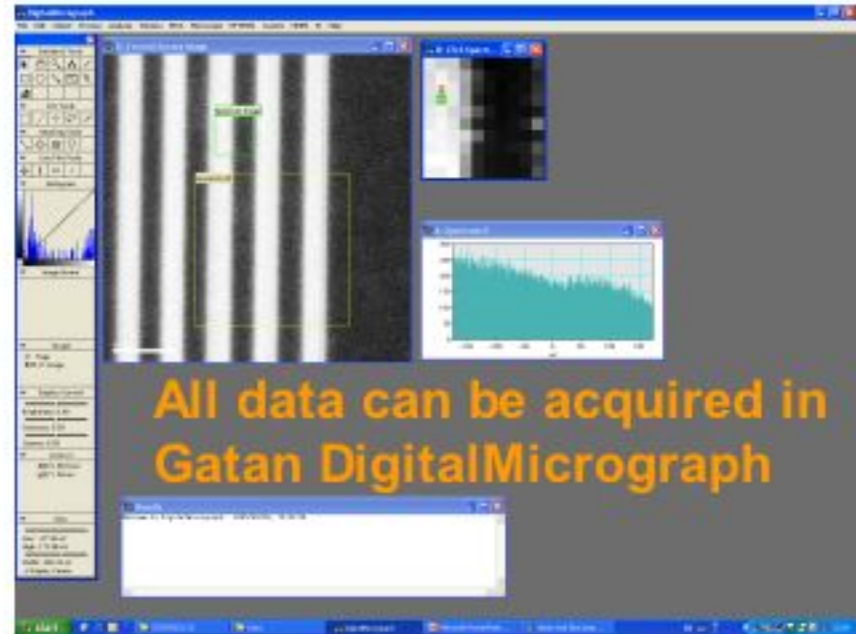
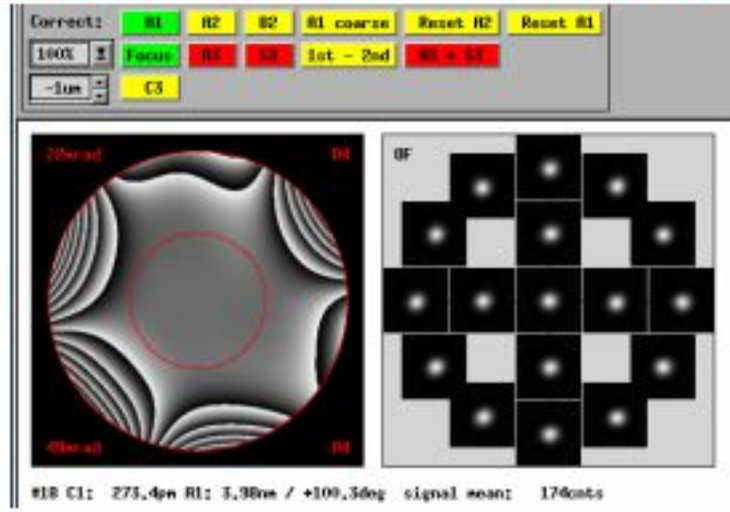


JEM-2200FS at Lehigh

CEOS STEM aberration-corrector



In-column Ω -filter





Network Diagram for Remote

NCEM

2: STEM

3: Gatan

CEOS

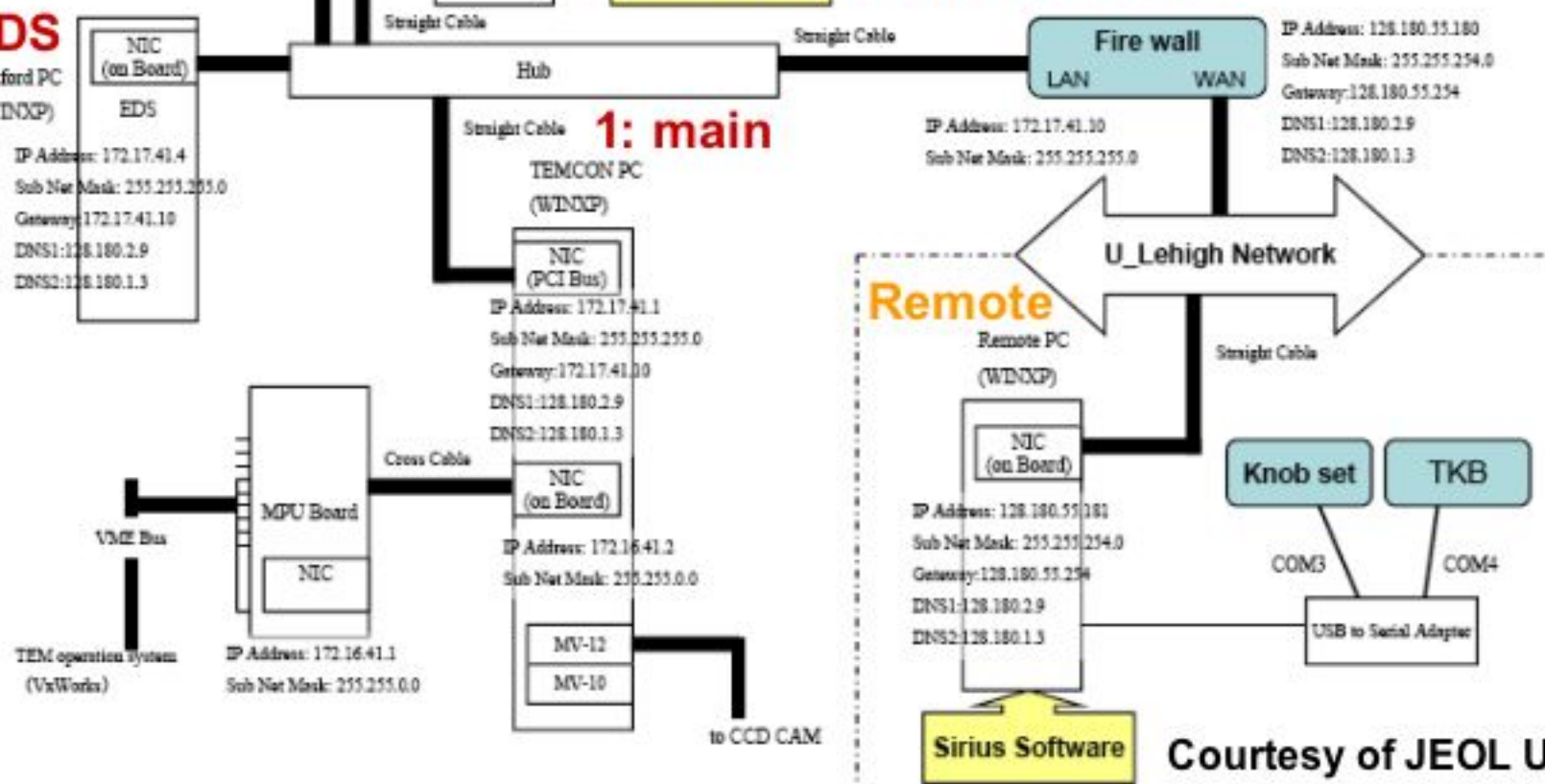
Network diagram plan at U_Lehigh.

Multiple PCs for the instrument can be connected from a single remote PC via Windows remote desktop

Sirius Software

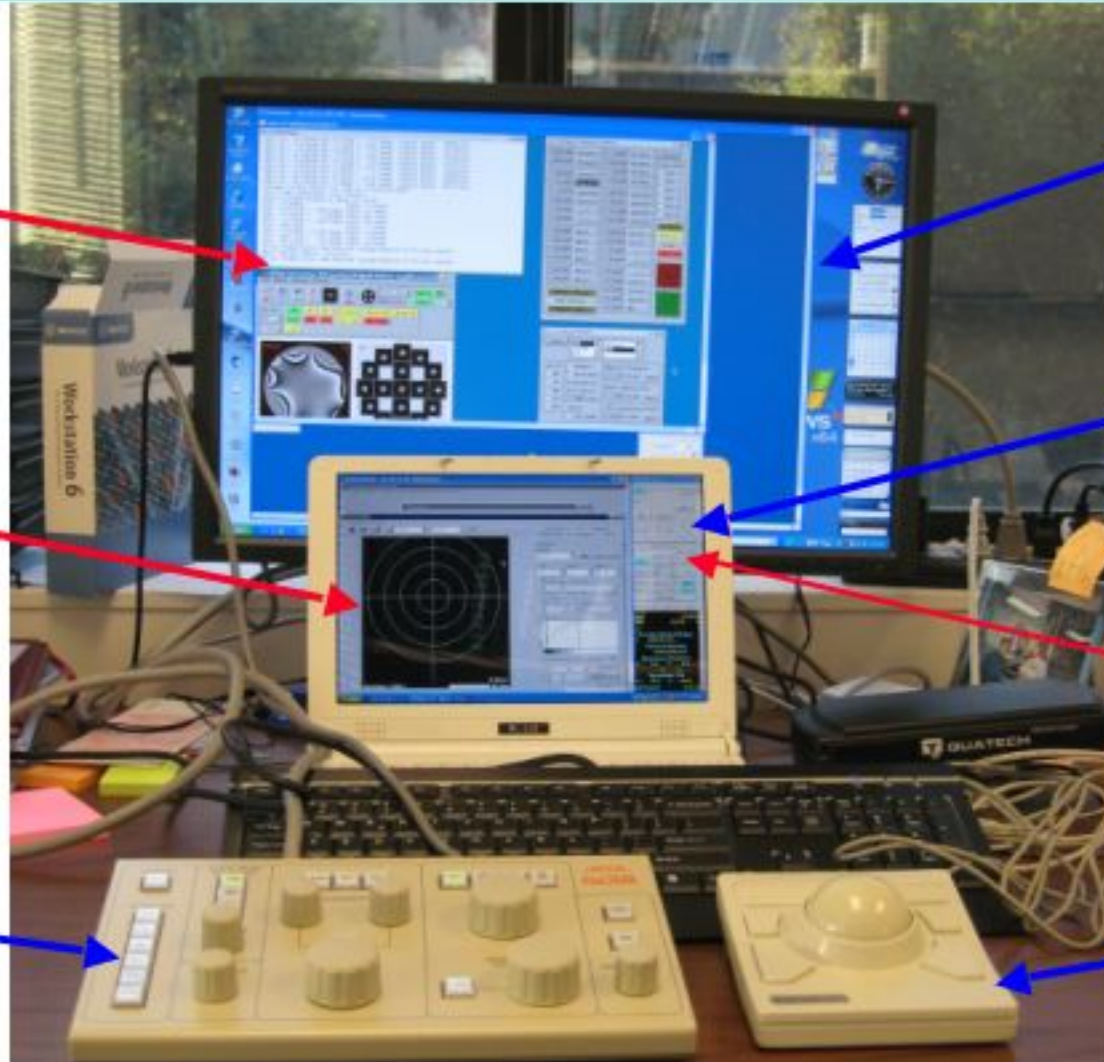
4: EDS

1: main



Courtesy of JEOL USA

Example of Remote Operation from NCEM



CEOS/
Gatan

TEMCON

DualCore
desktop

DualCore
laptop

Sirius client

knob set

track ball

Still a phone call is required for loading specimen
and filling Liq. N2 (**can be done with Skype!**)

Using JEOL Sirius system

Can be done

- Most of instrument alignments
- aberration-corrector tuning
- specimen shift
- specimen tilt
- TEM image acquisition
- STEM image acquisition
- X-ray data acquisition
- EELS data acquisition

Challenging to do

- On-the-fly data transfer
- Any alignment requires wobbling (needs over 3Gb/s?)
- Diagnosis of instrument status if something goes wrong (e.g. missing beam)

Impossible to do

- Filling liquid N₂
- Loading specimens

Controller: Knob Set vs. Touch Screen

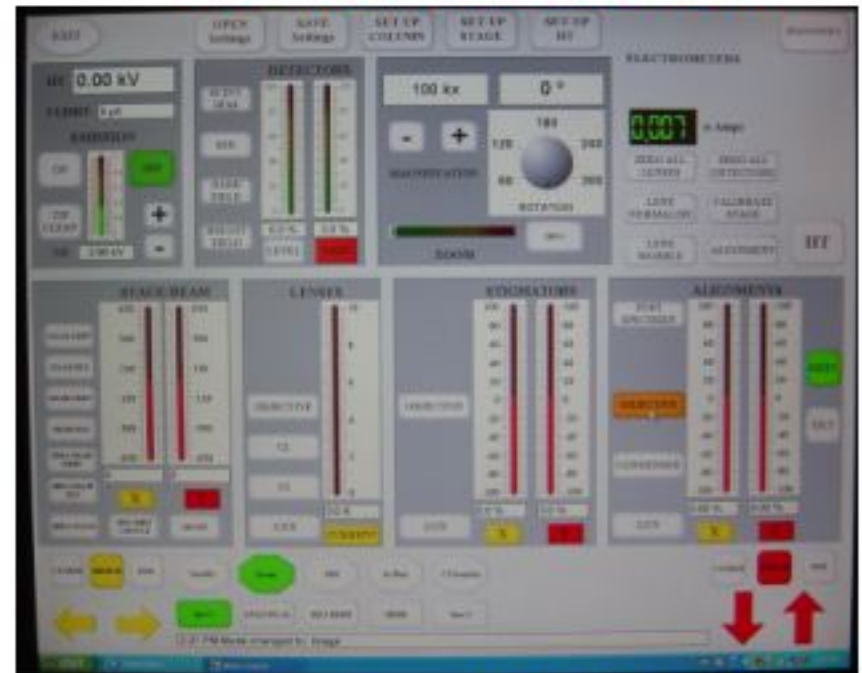
Good controller is essential for seamless remote operation in combination with software (can be achieved via remote desktop or VNC)

Hardware knob set for JEOL Sirius system



Almost same knob set
(can be operated seamlessly)
Expensive!

Touch screen for VG dedicated STEM



Courtesy of Andy Lupini (ORNL)

Slightly different from the knob set
for the local instrument
Less expensive!

- Intensive support from the local site is essential
 - load specimens
 - fill liquid N₂
 - **cover remote users' mess**
- Remote operations require faster network speed since these operations are video intensive.
(**slow-speed WiFi (from couch) should not be used**)
- Seamless controllers including software and hardware are very important
- Remote users must know how to operate the particular instrument **LOCALLY**.
The users should be trained locally before any attempt of remote operation.